

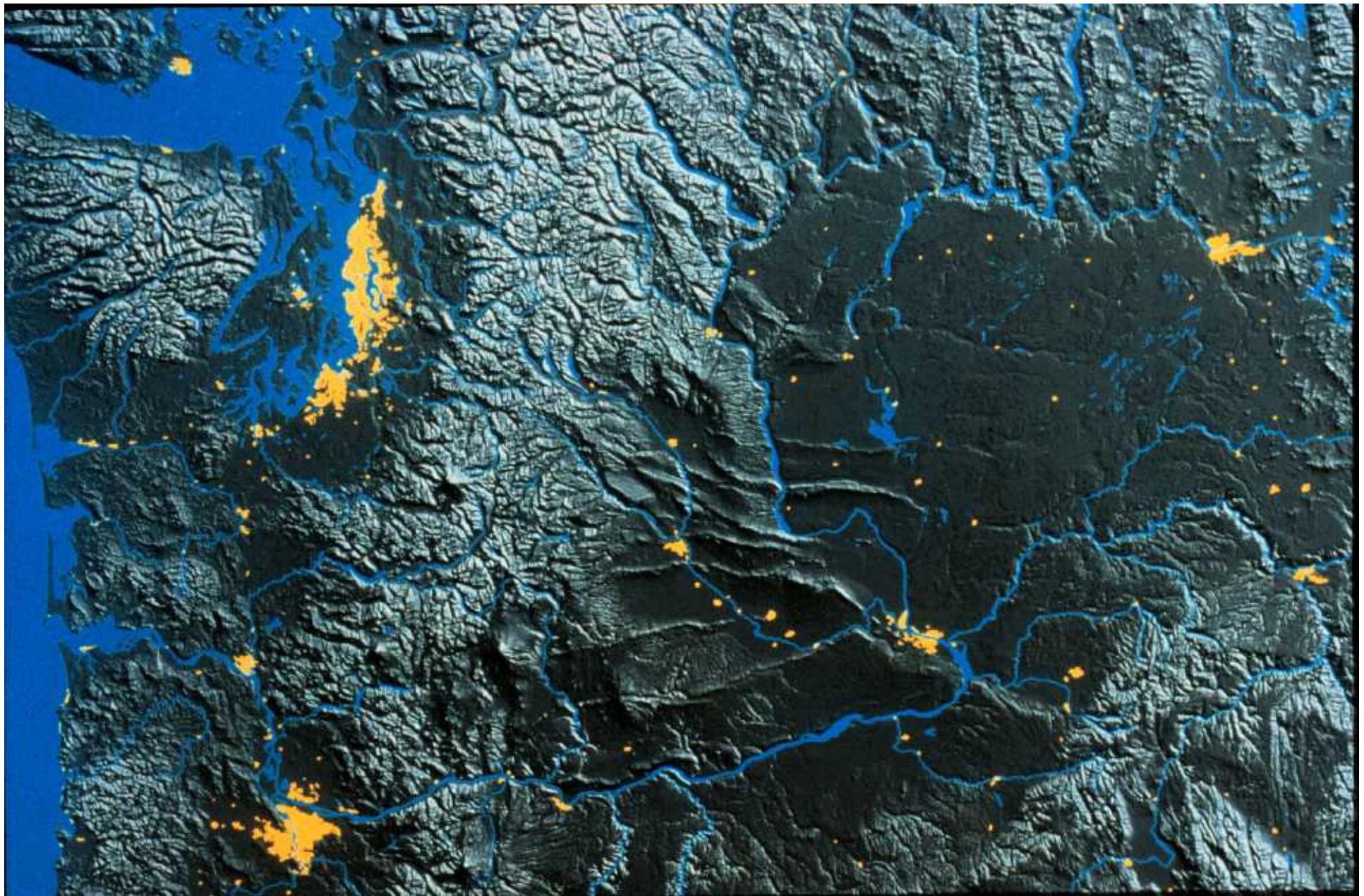
HRC stimulation of Cr-bioreduction at Hanford: *Site description, drilling, and Br tracer tests*

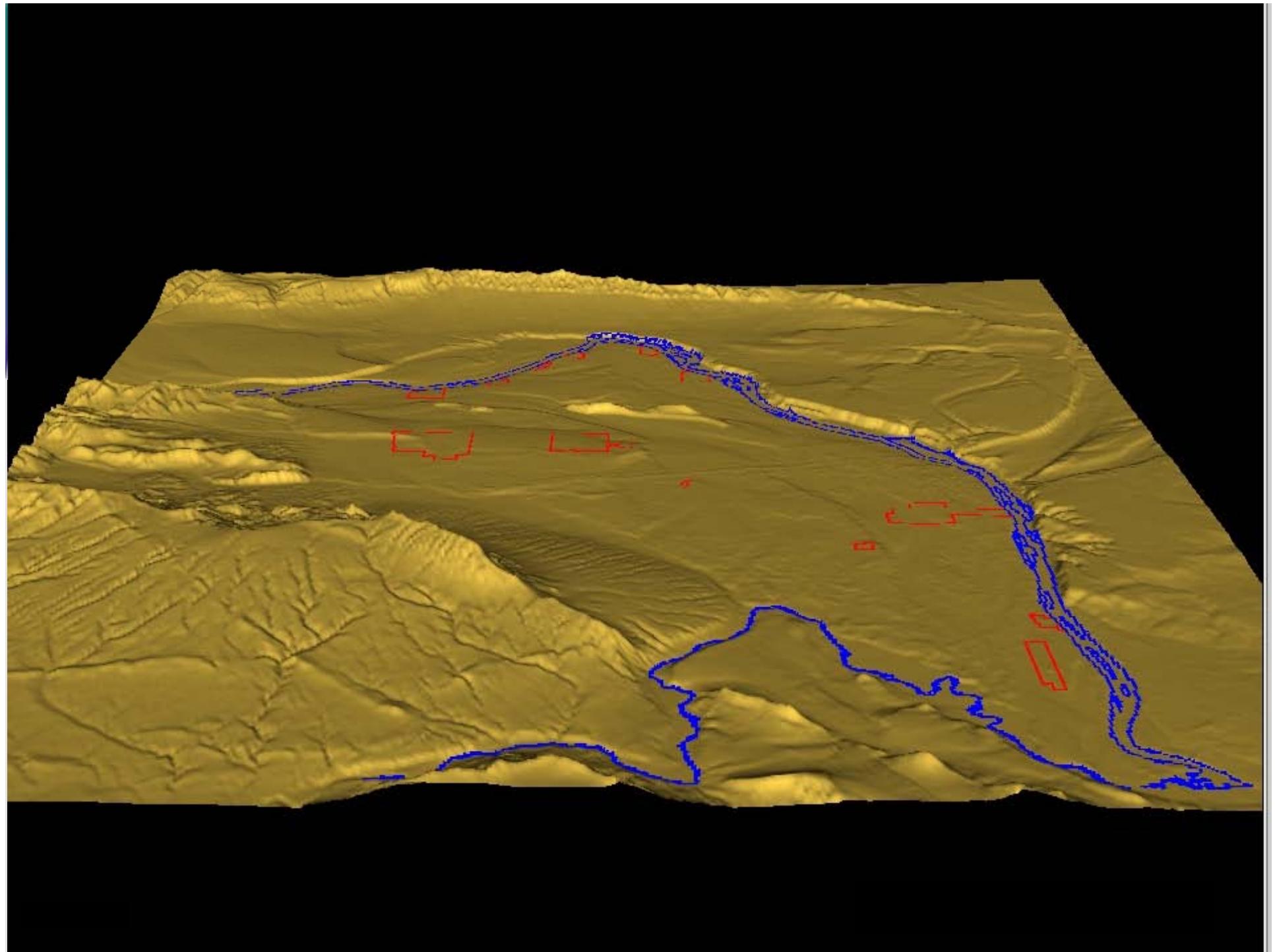
Phil Long, Kirk Cantrell, Darrell
Newcomer, Tom Resch

PNNL

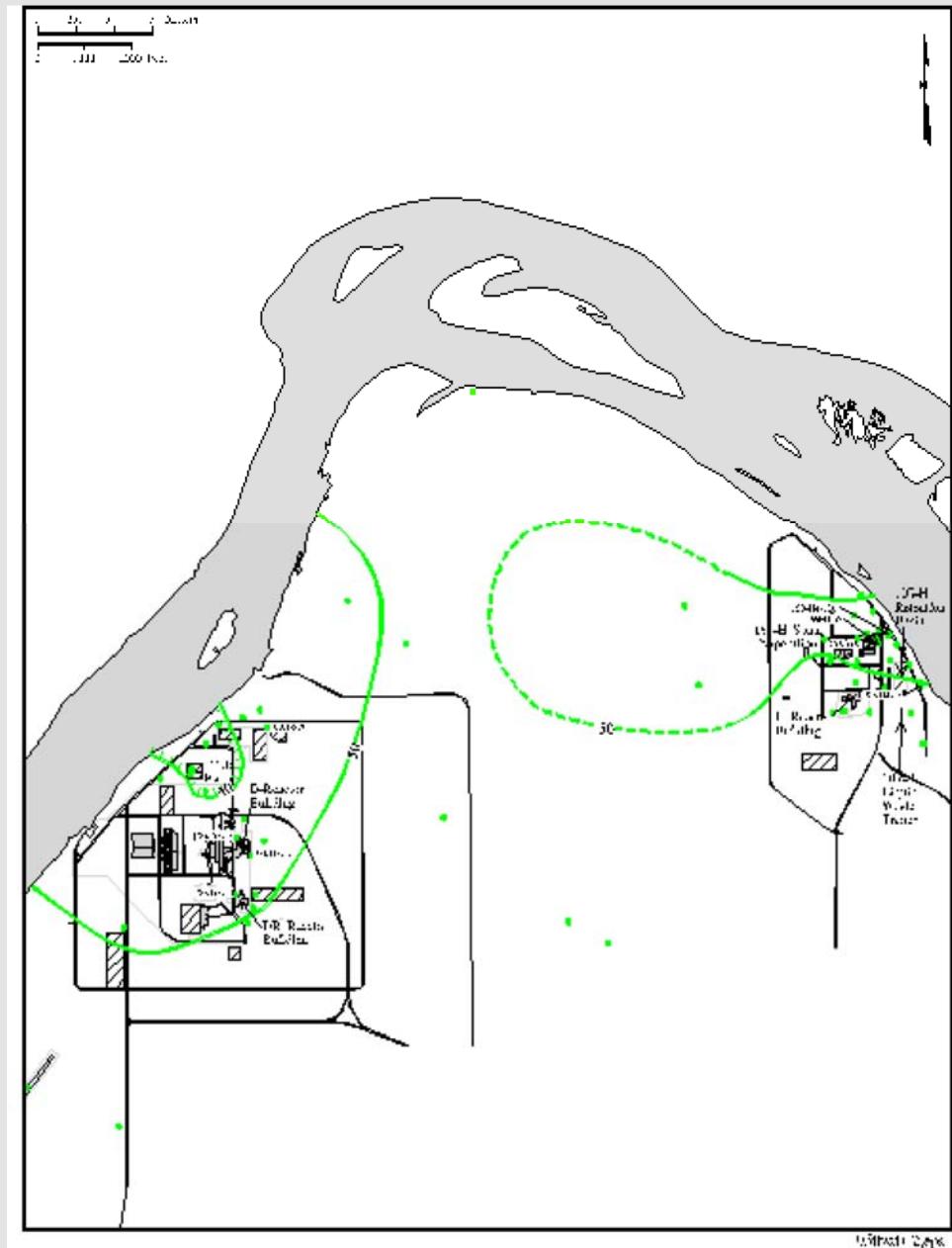
Outline of presentation

- ▶ Introduction
- ▶ Geohydrology and contaminant (Cr) source
- ▶ Overall experimental concept
- ▶ Well drilling and completion
- ▶ Tracer tests
 - Natural gradient
 - Forced gradient
- ▶ Next steps



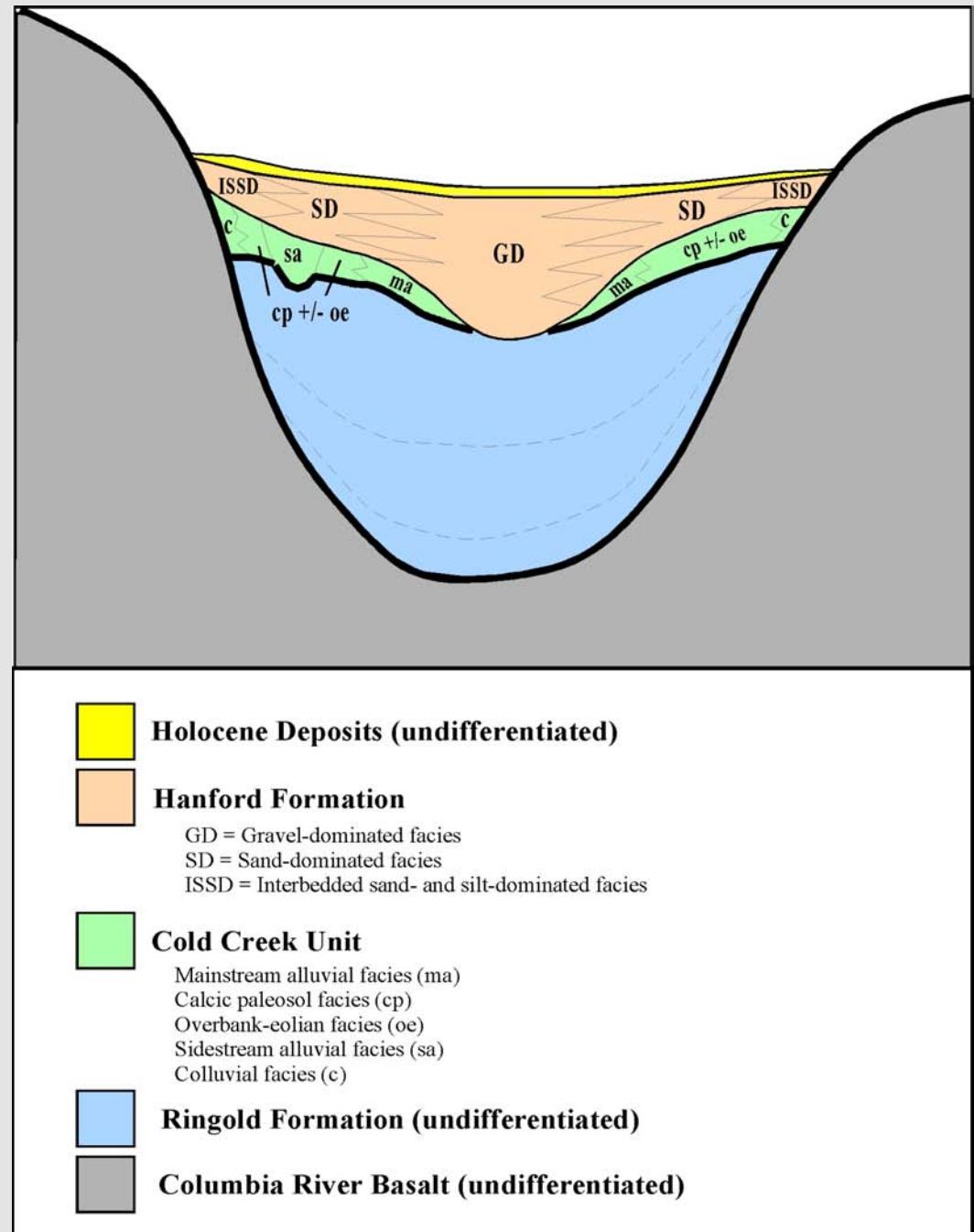
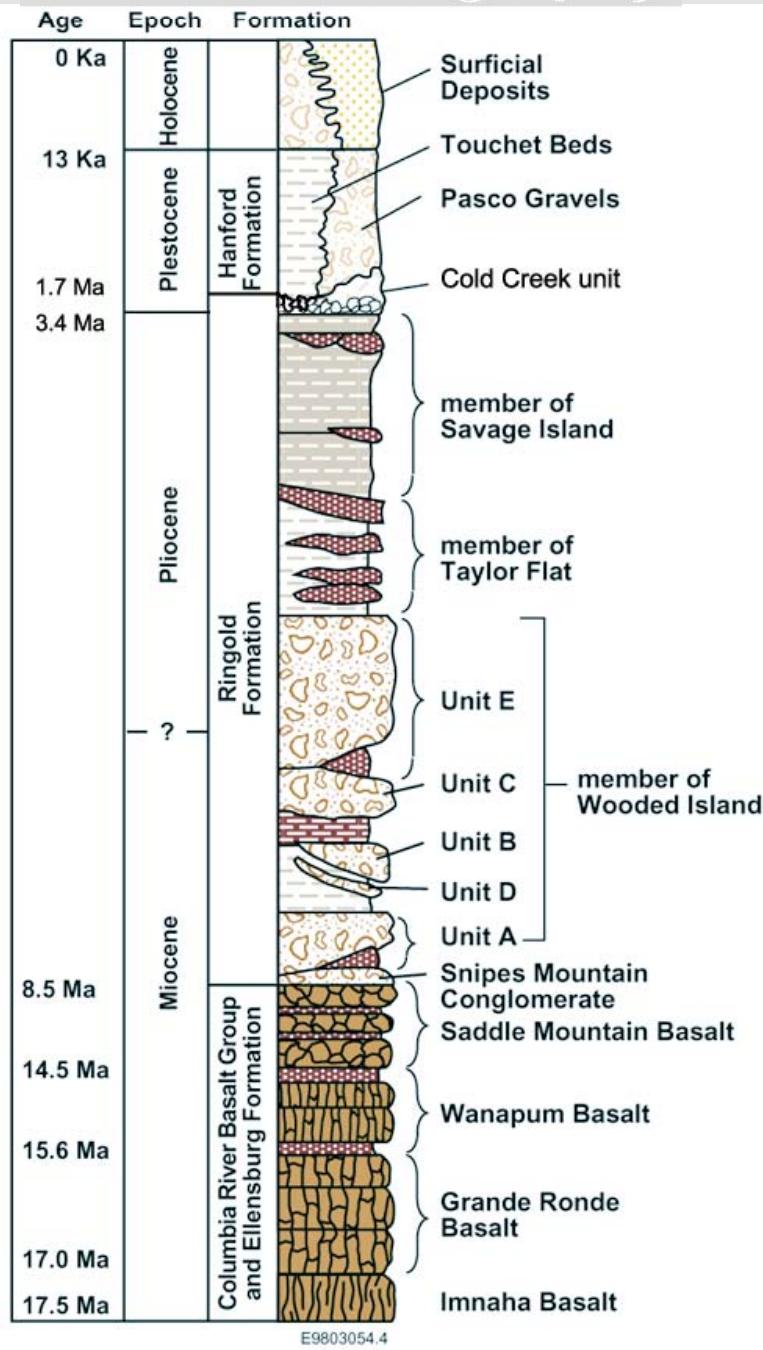


Chromate plumes at the Hanford Site





General Stratigraphy



Ringold Formation

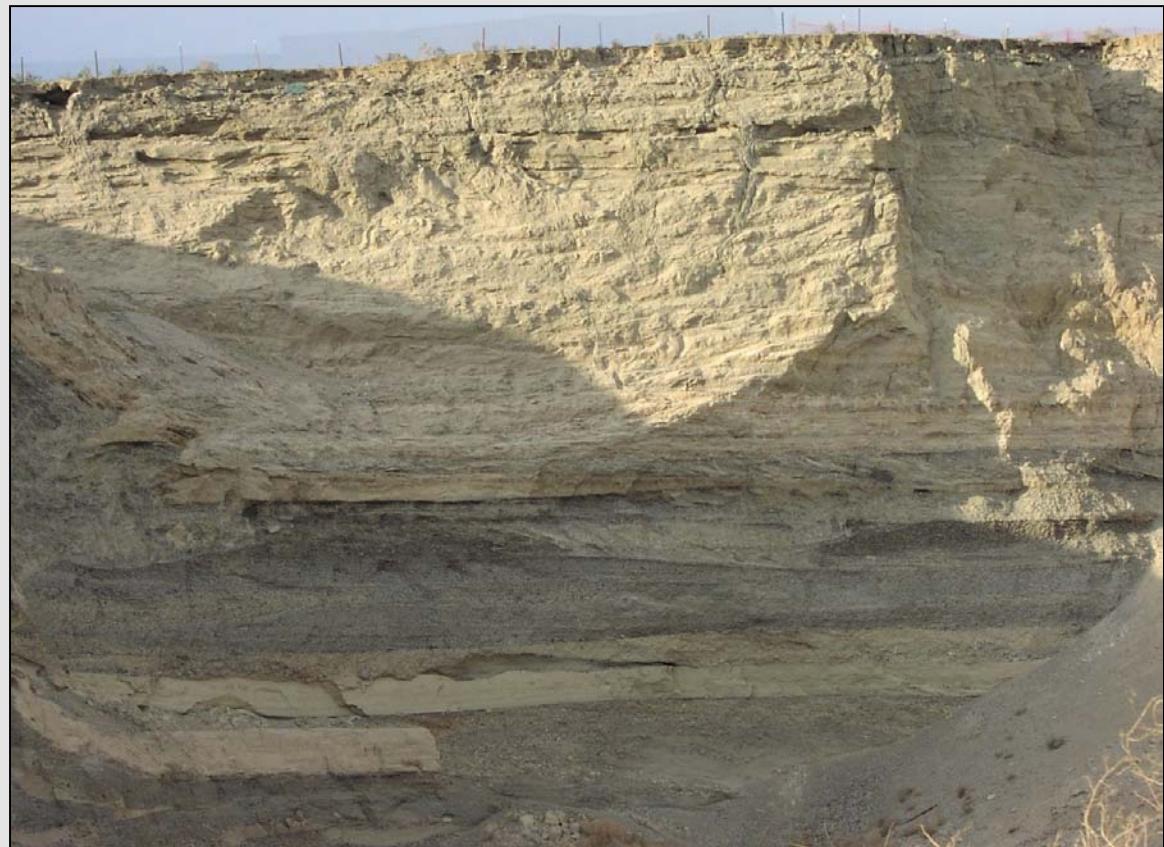


Erosional remnant of fine-grained Ringold Formation exposed along the White Bluffs

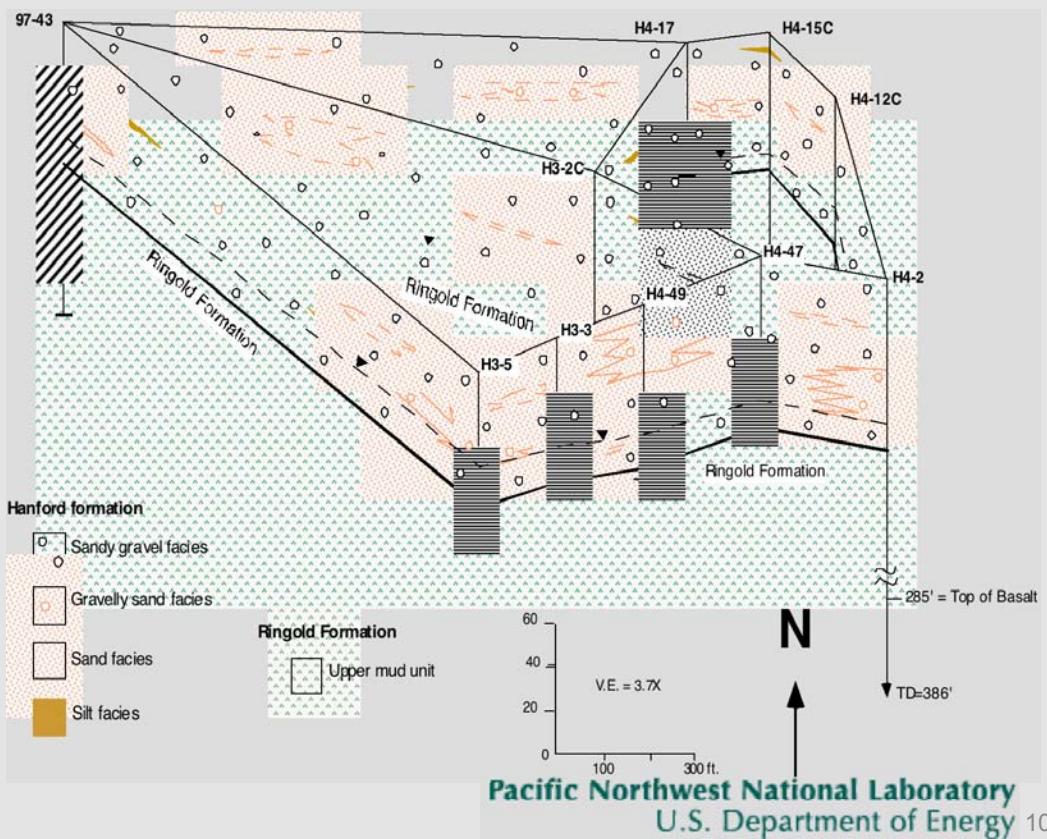
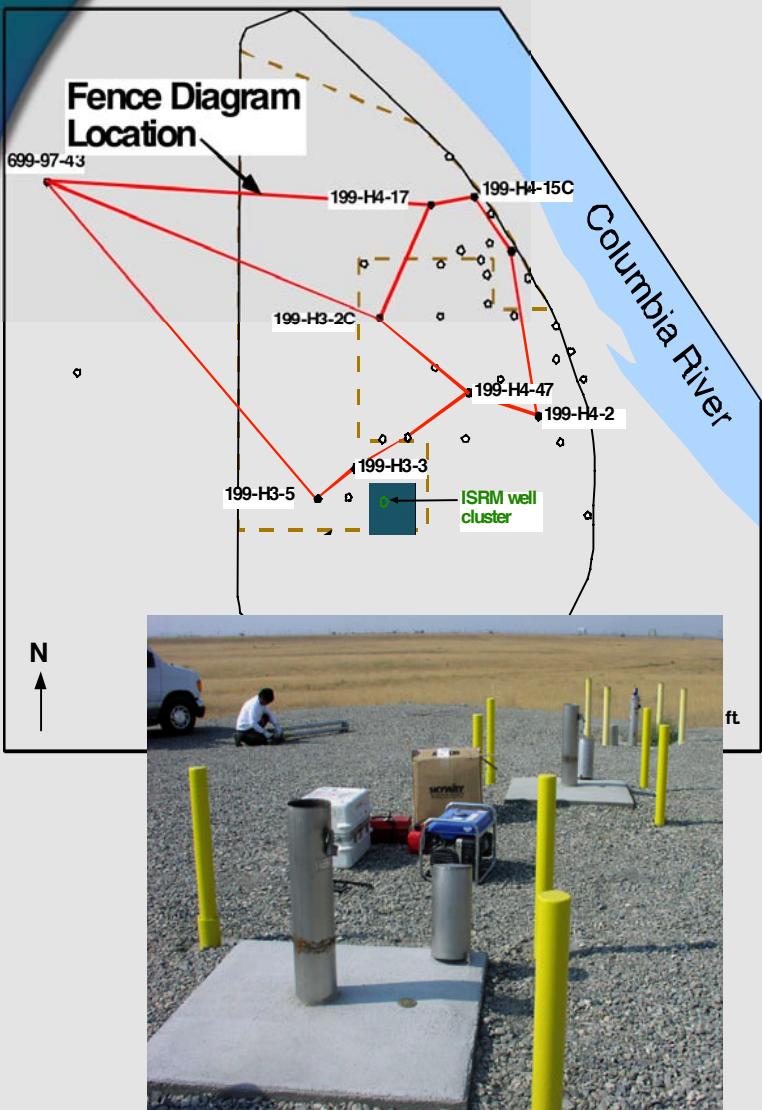
- ▶ Late Miocene to Pliocene age (3.4 to 8.5 Ma)
- ▶ Gravel, sand, silt, to clay
- ▶ Fluvial-lacustrine (ancestral Columbia River system)
- ▶ Post-Ringold incision removed up to 600 ft of Ringold Fm. from center of basin
- ▶ Moderately heterogeneous and anisotropic
- ▶ Comprises bulk of unconfined aquifer at Hanford

Hanford Formation

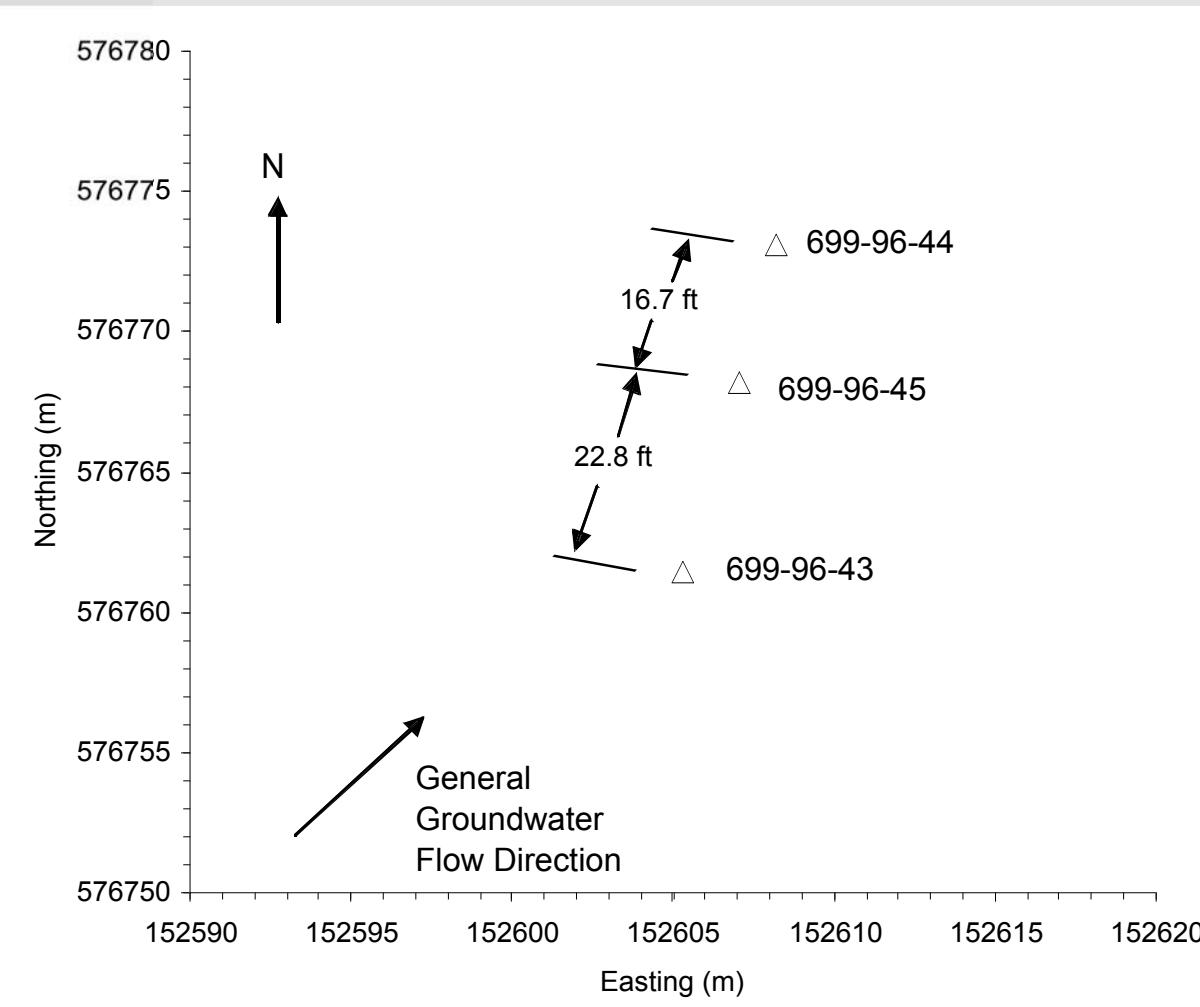
- ▶ Pleistocene age (13 ka to ~2.0 Ma)
- ▶ Coarse to fine gravel, sand, to silt
- ▶ Informal name for cataclysmic, Ice-Age flood deposits in the Pasco Basin
- ▶ Extremely heterogeneous and anisotropic
- ▶ Comprises bulk of vadose zone at Hanford



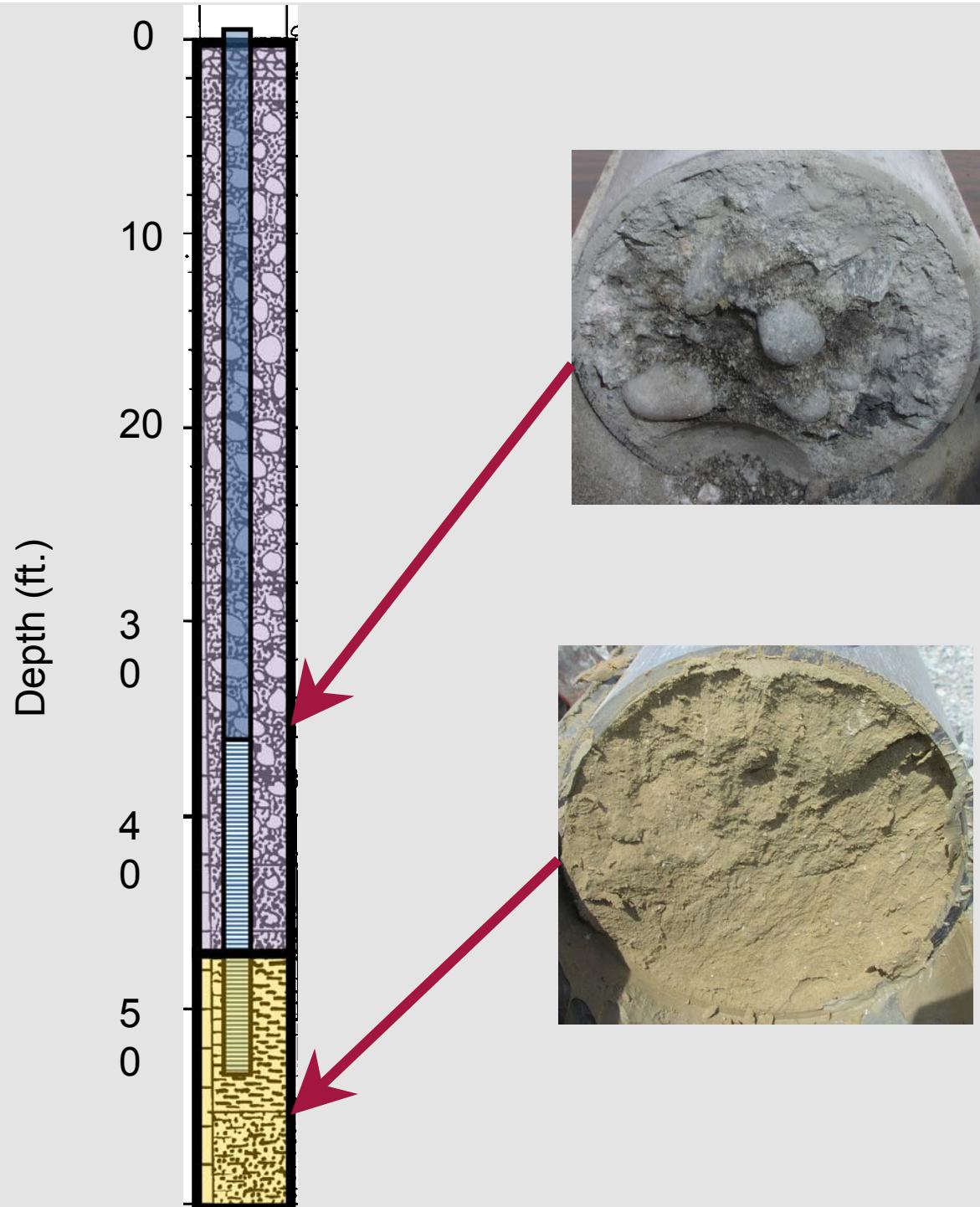
Ice-Age flood deposits in the southern Pasco Basin



Layout of Wells at Cr Bioreduction Site



Lithology and completion Diagram for 699-96-44



Split spoon samples from well 699-96-44

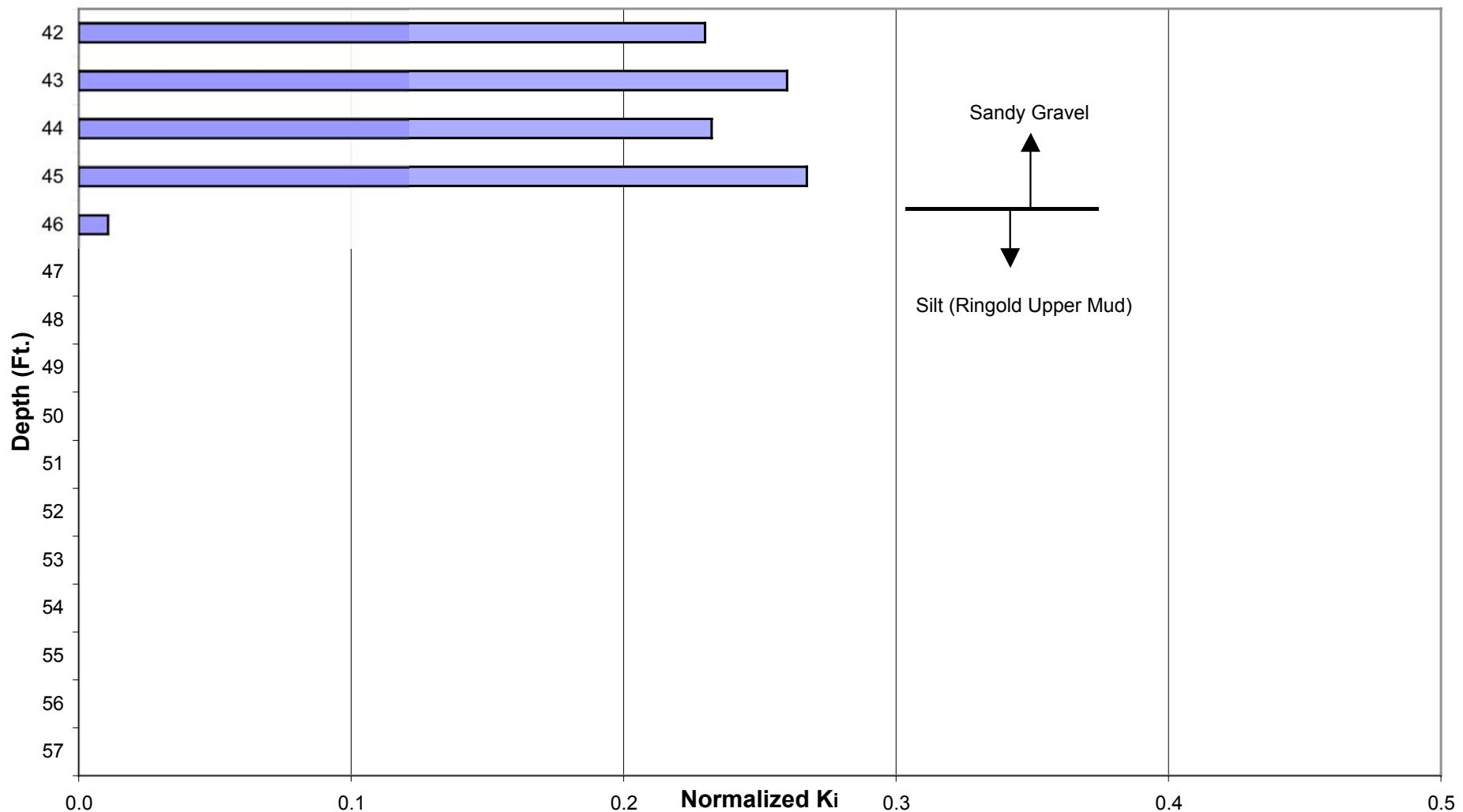


Hanford formation
37 feet



Ringold Formation
57 feet

Figure 7: Profile of Hydraulic Conductivity of Well 44



Modifications prior to forced gradient tracer test

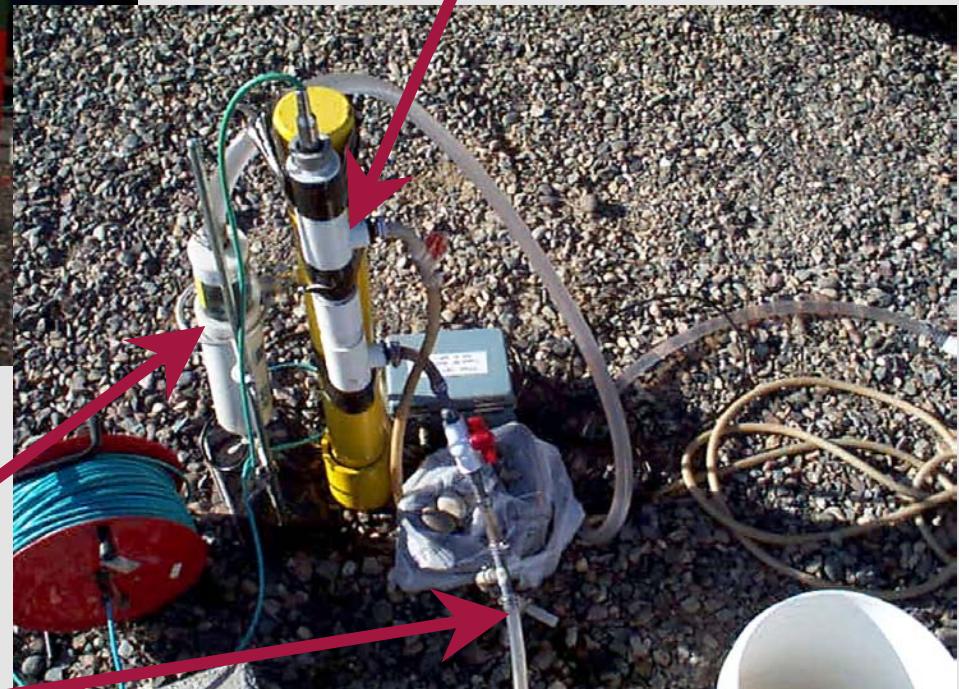


Hourly data collection during tracer test

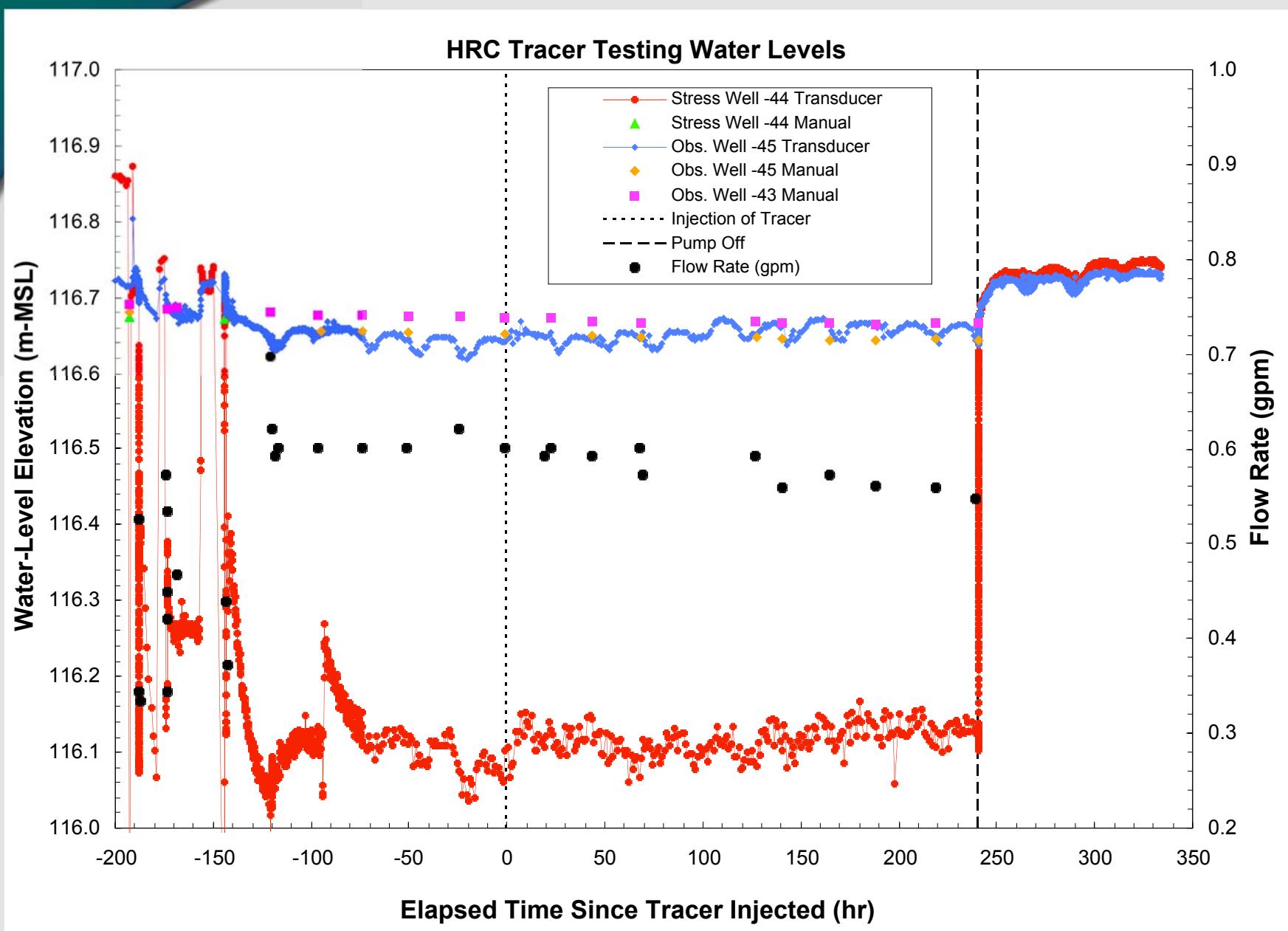


Flow cell with multiparameter probe
(pH, ORP, conductivity, T, DO)

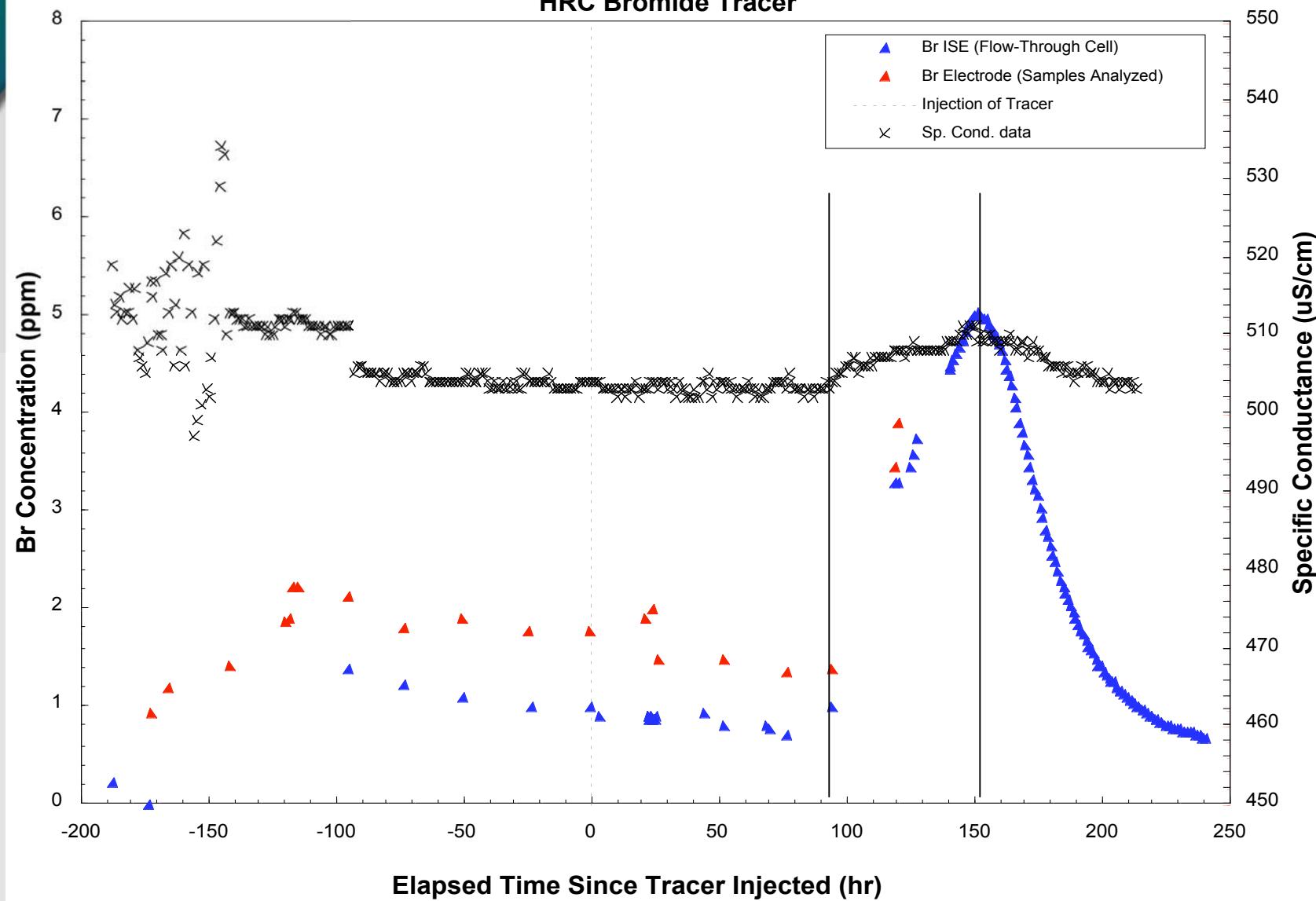
Sampling port



Flow cell with Br sensor



HRC Bromide Tracer



Next Steps

- ▶ Re-establish forced gradient (constant drawdown pumping regime)
- ▶ Inject Br just prior to HRC
- ▶ Inject HRC
- ▶ Inject Br into well bore only
- ▶ Continue pumping for 2 weeks, monitoring all parameters
- ▶ Sample weekly to monthly re-establishing forced gradient each time